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which may be called the trichophoric apparatus. When the trichogyne is multicellular the point where the antherozoid fuses may be far removed from the carpogenic cell. The form of carposporic reproduction is therefore of a type similar to that of many genera of Rhodophyceæ (*Callithamnion*, *Spermothamnion*, *Griffithsia*, etc.), *i. e.*, the stimulus of fertilization must be transferred through several cells before it reaches the carpogenic cell. It should be said that the cells of the trichogyne communicate with one another by strands of protoplasm, a fact also true of the cells of all other parts of these fungi and an interesting point of resemblance to the Rhodophyceæ. There is therefore open protoplasmic communication from the tips of the trichogyne to the carpogenic cell.

However, it should be noted that this fact by no means solves the problem of how fertilization is accomplished. Accepting the everywhere prevalent view that fertilization consists in the fusion of two sexual nuclei, we must imagine the nucleus of the antherozoid to pass the length of the trichogyne from cell to cell, finally fusing with the female nucleus of the carpogenic cell. Such a phenomenon, the writer believes, is entirely unknown in the plant or animal kingdom, and it is extremely difficult to conceive the mechanism by which a sex nucleus could pass through a series of nucleated cells. The high degree of specialization of the sexual organs indicates, however, that sexuality is in an advanced state of differentiation in these forms.

The discovery of such a remarkable sex process in the Laboulbeniaceæ is an important contribution to the rapidly accumulating mass of evidence proving sexuality to be present among the ascomycetes. The observations are of particular interest in connection with Stahl's discovery of a trichogyne in *Collema*. Nevertheless it is manifest that we are far from a solution of the problems presented by the carposporic type of reproduction in the ascomycetes, although it is equally plain that the difficulties are not to be swept aside by a denial of sexuality after the fashion of Brefeld and his followers.—B. M. D.

MINOR NOTICES.

THE EXAMINATION of a set of *Lichenes Boreali-Americani*, now having reached 140 numbers, shows that the authors, Clara E. Cummings, Thos. A. Williams, and A. B. Seymour, are distributing material of the highest quality and from widely different localities. The first set, known as *Decades of North American Lichens*, and containing 210 numbers, was begun in 1892. In 1894 the second set, known as *Lichenes Boreali-Americani*, was begun. It is to be hoped that the extensive distribution of these authentic sets will stimulate the study of a group to which too few botanists are giving serious attention. No effort to send out consecutively numbered sets has been made since Tucker-

man's day. To make the distribution of the greatest value the active cooperation of botanists is necessary, as extensive collections from different parts of the country should be in the hands of the authors. The subscription price for each decade is seventy-five cents, which may be sent to Clara E. Cummings, Wellesley, Mass.—J. M. C.

IT APPEARS like a relic of the ancient artificial systems to separate an "arborescent flora" from the other plants of a country, but when the Division of Forestry prepares a work on nomenclature it has no choice in the matter. Mr. George B. Sudworth, dendrologist of the Division, has prepared an extensive bulletin⁹ which presents the mass of synonymy that belongs to our arborescent plants and adds largely to it. It is coming to be apparent that laws of nomenclature, like most laws, are not so important as their interpretation, and that a code to be effective for uniformity must be followed up by rulings that will embrace the widest possible combination of conditions.

Mr. Sudworth also seeks to unify the popular names, so that when a western man calls upon New England for honey locust he will not get locust. Mr. Sudworth has been of great service in bringing together such a mass of references, a very necessary work, but one from which almost any botanist naturally shrinks. Whether he has associated these names properly or not in his synonymy remains for monographers to decide. The introduction of new varietal, specific, and generic names is the logical result of any such undertaking, but so far as they are expressions of individual judgment and not purely mechanical they do not lead to greater simplification of nomenclature. It is a question whether our knowledge of plants in general and their literature will ever be so complete that even the majority of changes can be mechanical. But these are thoughts suggested by the problem of nomenclature in general, and not by Mr. Sudworth's work in particular, which shows a large amount of painstaking labor, and is certainly a valuable contribution to the bibliography of our arborescent plants.—J. M. C.

THE REPORT of the Pennsylvania Forestry Commission¹⁰ has recently appeared. The commission consisted of two members, Mr. Wm. F. Shunk, an engineer, who discusses the water sheds and waterflow of the state and the relation of forest cover thereto, and Dr. J. T. Rothrock, botanist, who is responsible for much the greater part of the volume. The commission was charged with the duty of making a preliminary survey of the forestry interests of the state, and it has been succeeded by a well organized department, with Dr. Rothrock in charge of forestry. The report has for its object

⁹ SUDWORTH, GEORGE B.—Nomenclature of the arborescent flora of the United States. Bulletin 14, Division of Forestry, Department of Agriculture, pp. viii+419. January 21, 1897.

¹⁰ Report of the Department of Agriculture, Part II. Division of Forestry. 1895.

the education of the people upon the relation of forests to waterflow and to soil conservation, the intrinsic value of forest products, and the importance of forest cover as a public resource. The discussions of these matters are clear and convincing, and they are so simply worded as to be within the comprehension of every citizen. It is unfortunate, perhaps, that more complete data of existing forest areas, extent of forest fires and waste lands, are not furnished, but the time of the commission was limited, and all things considered the report is calculated to fulfill its purpose. From the standpoint of the trained botanist the report contains little that is new or of special value, but the teacher of botany can find here a good example of the simplified treatment of his subject. Dr. Rothrock's descriptions of the economic trees of Pennsylvania are given entirely in colloquial English, without recourse to technical terms, and in thus keeping constantly in mind the needs of his readers he proves himself a master of the art of popular instruction. As an instance of luminous treatment of a difficult group, his discussion of the oaks may be cited. There is a simple classification, an occasional forestal reference that no mere book learned botanist could have given, but which appeals strongly to men who know trees from the woodman's standpoint, and a setting forth of specific characteristics that is altogether praiseworthy. There is a lack of editing in several contributed articles that is unfortunate, in that it lowers the standard of the volume from the high plane of the compilers. The illustrations are numerous and noteworthy, since in themselves they tell the story of the forest and its enemies.—B. E. F.

DR. A. ENGLER has just published a study of the geographical distribution of the Rutaceæ with relation to their systematic arrangement.¹¹ The contribution furnishes excellent argument and example for the pursuit of all taxonomic investigation with reference both to phylogeny and distribution. More than twenty years ago Dr. Engler began his exhaustive study of the Rutaceæ and allied families, but scarcely a year before the appearance of this recent publication he had prepared the treatment of the group which appears in the *Pflanzenfamilien*. In his earliest work upon the family the author emphasized the presence of oil glands as a character of much taxonomic convenience, pointing out that upon the basis of flower parts they may not be separated easily from the nearly related Geraniaceæ, Zygophyllaceæ, Simarubaceæ, Burseraceæ, and Meliaceæ. Taking in order the subfamilies Rutoideæ, Toddalioidæ, and Aurantioideæ, and under each its further subdivisions, the chief portion of the paper is devoted to a treatment of distribution by genera, from which the following grouping by distribution is made: (1) groups, especially Rutoideæ-Diosmeæ, and Rutoideæ-

¹¹ Ueber die geographische Verbreitung der Rutaceen im Verhältniss zu ihrer systematischen Gliederung. Verlag der Königl. Akademie der Wissenschaften, Berlin. 1896.

Boroniace, which display a wide range of nearly related forms of limited distribution; (2) groups, as Xanthoxyleae-Evodiinae in eastern Australia, and Xanthoxyleae-Decatropidinae in Mexico and West Indies, which show a considerable number of widely separated forms or genera confined to limited areas; (3) groups and genera possessing more or less numerous forms in widely separated localities; (4) single groups and genera of few forms which occur in widely separated regions; (5) certain isolated genera, as *Spathelia*, *Chloroxylon*, and *Dictyoloma*, whose derivation the author believes to have been from a stock distinct from that of the more widely distributed groups of Rutaceae. By means of color upon map outlines, three handsome plates, which accompany the text, graphically represent the distribution of particular genera, and by elucidating the text add greatly to the comfort of the reader.—J. G. C.

NOTES FOR STUDENTS.

THE ALMOST simultaneous announcement of the discovery of spermatozoids in *Ginkgo biloba*¹² and *Cycas revoluta*¹³ is one of the most startling botanical announcements of recent years. The work of Ikeno upon *Cycas revoluta*, begun three years ago, attracted attention from his announcement of a distinct ventral canal cell,¹⁴ the existence of which was in doubt. These various announcements, however, are very brief and are but preliminary to the full illustrated papers which will be awaited with great interest.

In the case of *Ginkgo biloba* Hirase has observed the following facts: The pollen grain consists of two prothallial cells and the tube cell, the latter developing a much branched tube, the branches of which spread out over the surface of the thin nucellus cap. The innermost of the two prothallial cells enlarges and divides to form the stalk and generative cells. The generative cell then divides and the two daughter cells form motile spermatozoids, instead of the customary non-motile male cells. The spermatozoids are egg shaped, $49 \times 82\mu$, and have a central nucleus completely surrounded by cytoplasm. The head consists of a three-coiled spiral with numerous cilia, and a pointed tail was also observed. Within the nucellus above the archegonia there is an abundant liquid, probably secreted by the archegonia, in which the spermatozoids were observed to swim about with a rotating motion.

In *Cycas revoluta* Ikeno obtained almost identical results. The spermatozoids are a little larger than those of *Ginkgo* and the head is a spiral with four turns bearing numerous cilia. The production in each pollen tube of

¹² S. Hirase (Tokyo) in *Botanical Magazine*, Oct. 1896, and in *Bot. Central*. Jan. 14, 1897.

¹³ S. Ikeno (Tokyo) in *Botanical Magazine*, Nov. 1896, and in *Bot. Central*. Dec. 30, 1896.

¹⁴ Bot. Central. 33:193. 1896.